

Bryan Stiles and Brian Pollard

Jet Propulsion Laboratory

California Institute of Technology

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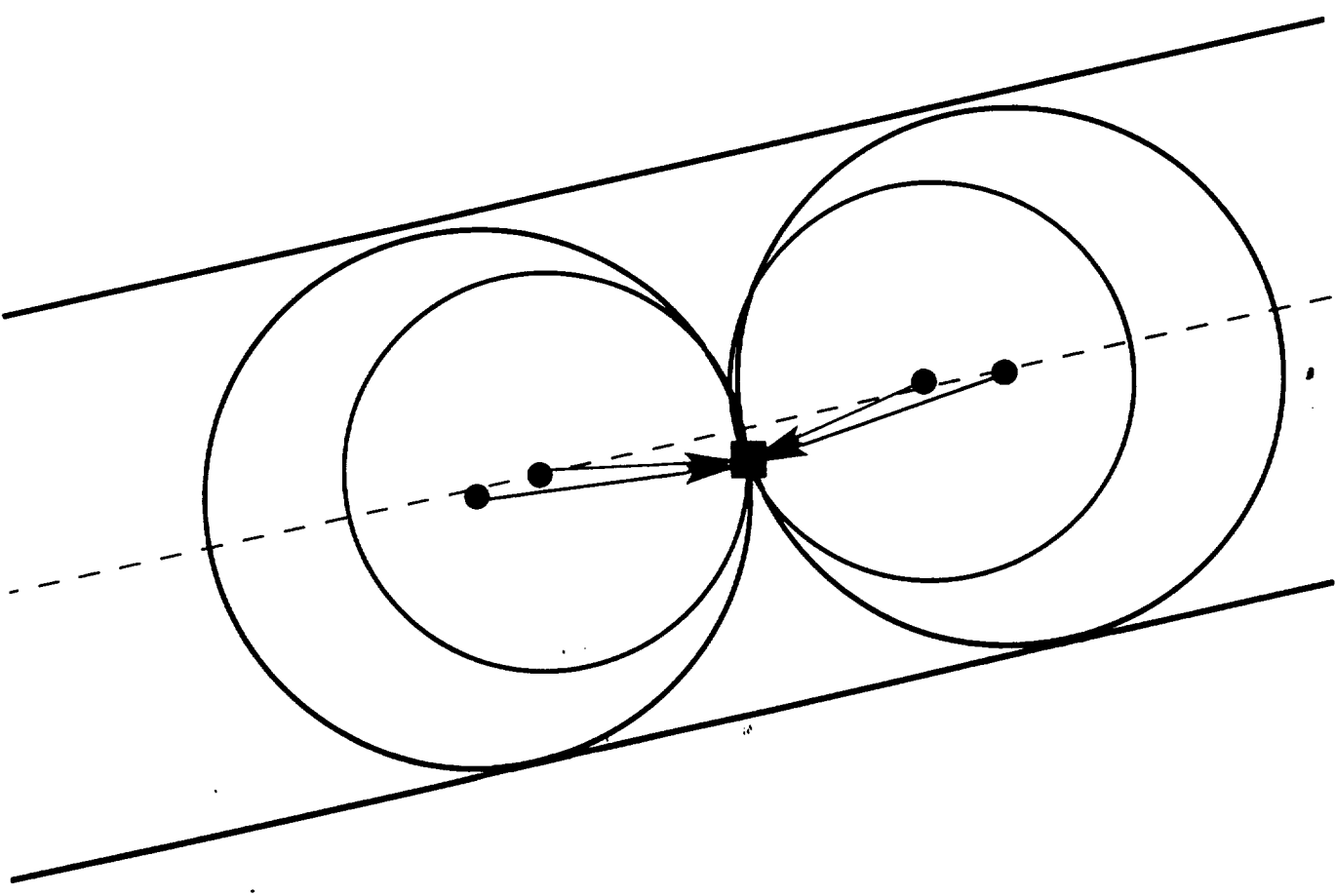
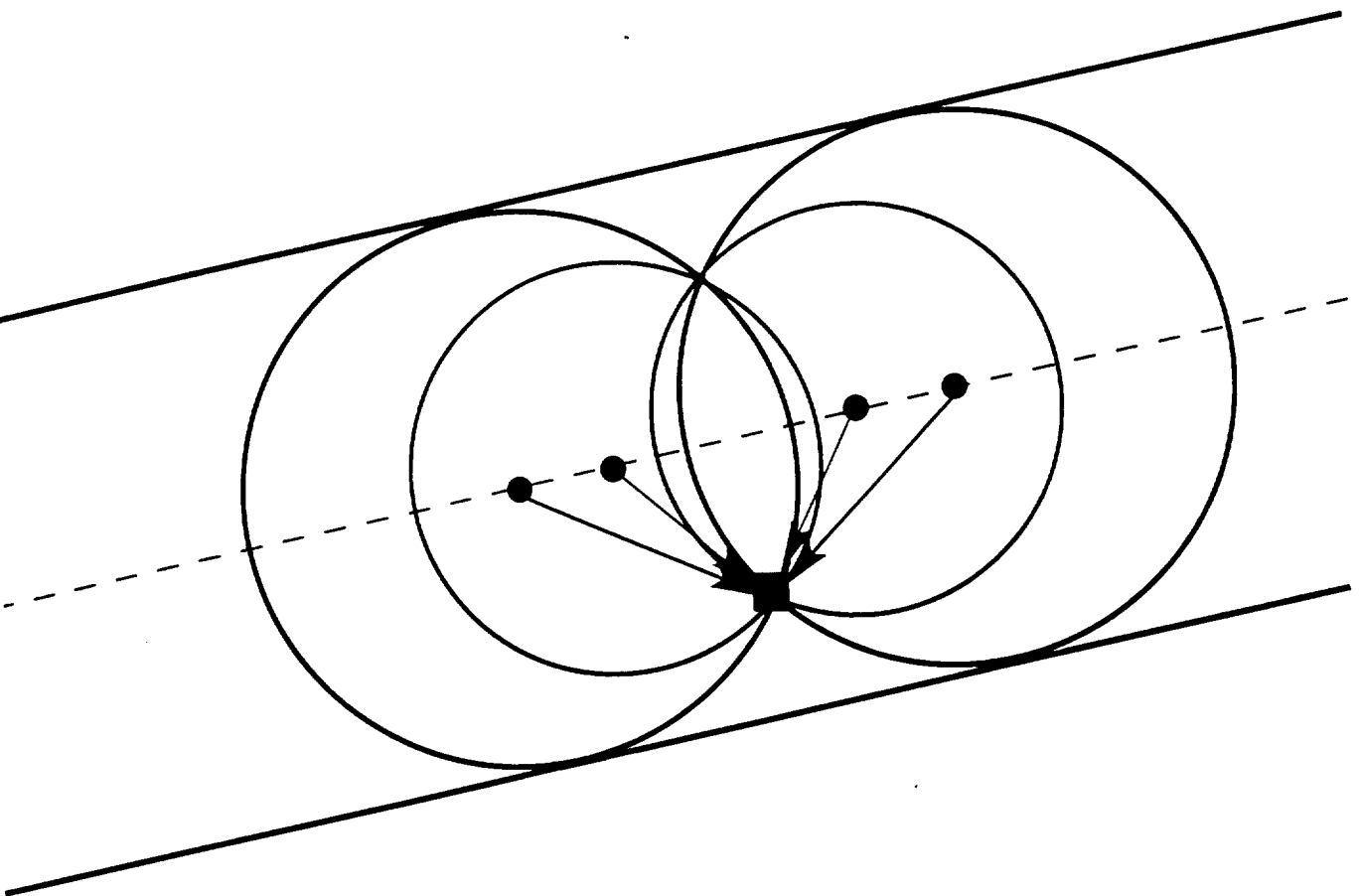
For more information
contact:

- Bryan Stiles
4800 Oak Grove Dr.
Mail Stop 300-319
Pasadena, CA 91109
- Bryan.W.Stiles@jpl.
nasa.gov

Abstract

The SeaWinds on QuikSCAT scatterometer was developed by NASA JPL to measure the speed and direction of ocean surface winds. Simulations performed to estimate the performance of the instrument prior to its launch have indicated that the mid-swath accuracy is worse than that of the rest of the swath. This behavior is a general characteristic of scanning pencil beam scatterometers. For SeaWinds, the accuracy of the rest of the swath, and the size of the swath are such that the instrument meets its science requirements despite mid-swath shortcomings. However, by understanding the problem at mid-swath, we can improve the performance there as well. We discuss the underlying causes of the problem in detail and propose a new wind retrieval algorithm which improves mid-swath performance. The directional discrimination ability of the instrument varies with cross track distance, wind speed, and direction. By estimating the range of likely wind directions for each measurement cell, one can optimally apply information from neighboring cells where necessary in order to reduce random wind direction errors without significantly degrading the resolution of the resultant wind field. In this manner we are able to achieve mid-swath RMS wind direction errors as low as 15 degrees for low winds and 10 degrees for moderate to high winds, while at the same time preserving high resolution structures such as cyclones and fronts.

Measurement Geometry



Sweet Spot

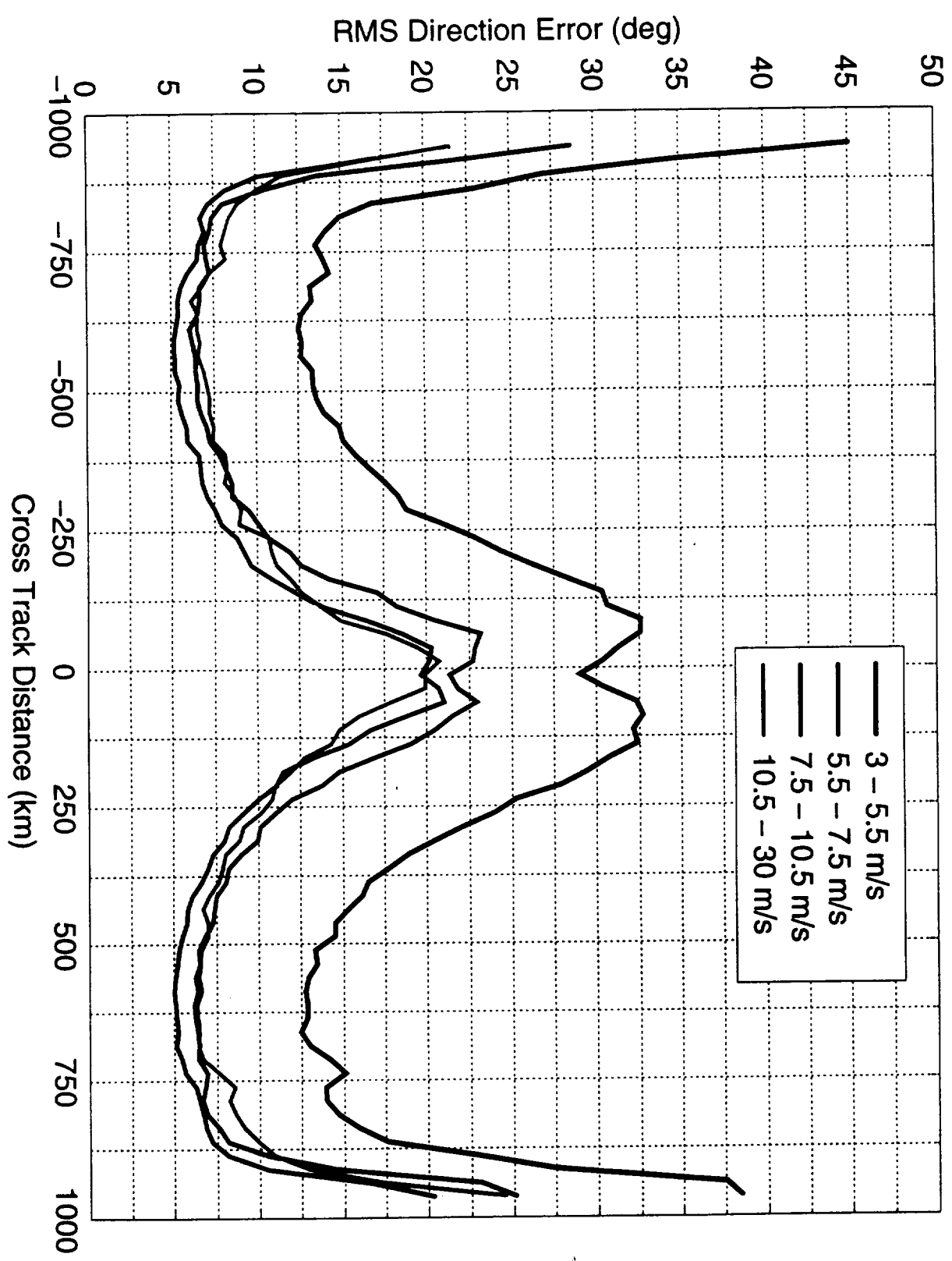
Mid-Swath

Standard Wind Retrieval Algorithm

- pointwise wind retrieval
 - maximum likelihood estimator
 - multiple peaks in objective function
- ambiguity removal
 - initialization using an external model (“nudge”) wind field
 - multi-pass median filtering

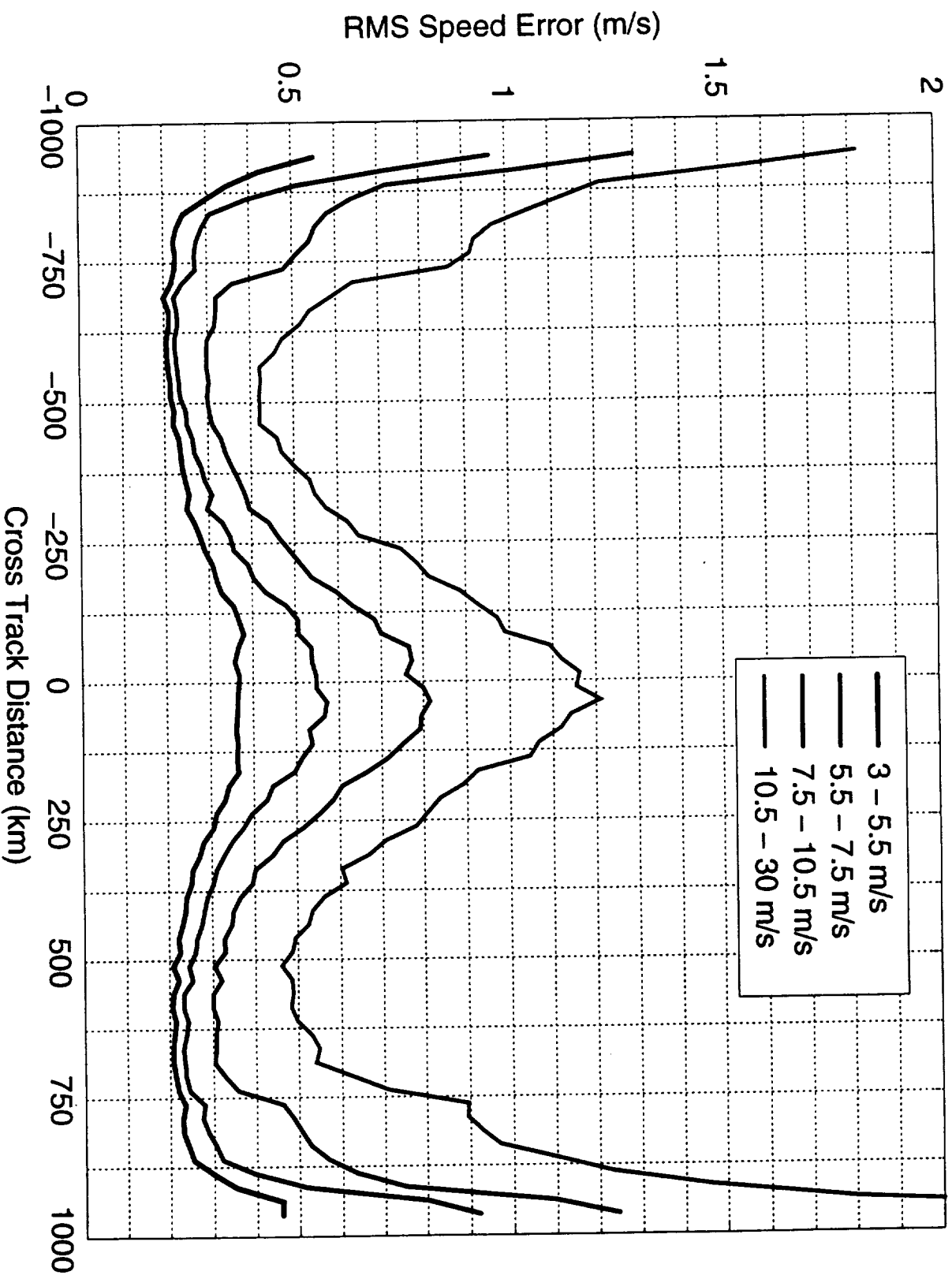
Baseline Nearest RMS Direction Error

25 orbits

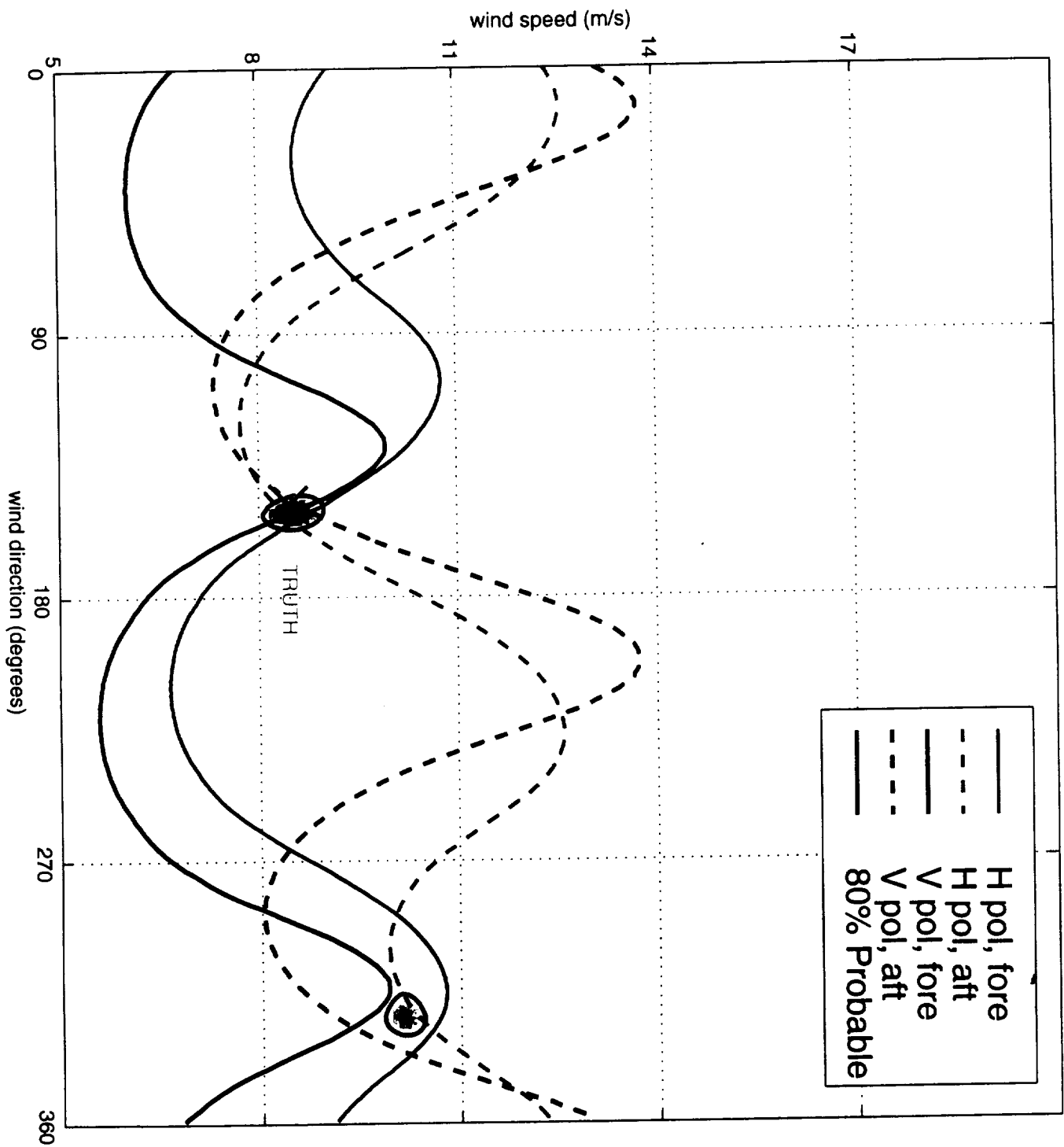


Baseline Nearest RMS Speed Error

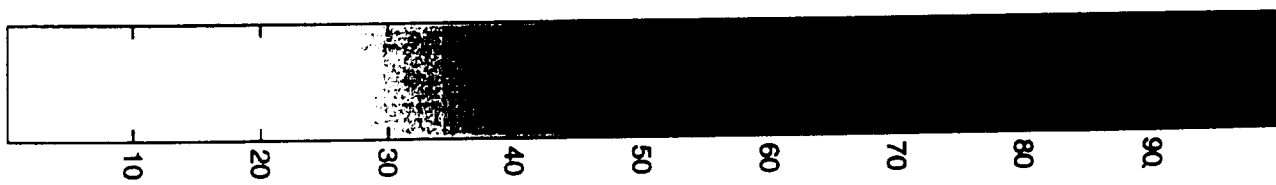
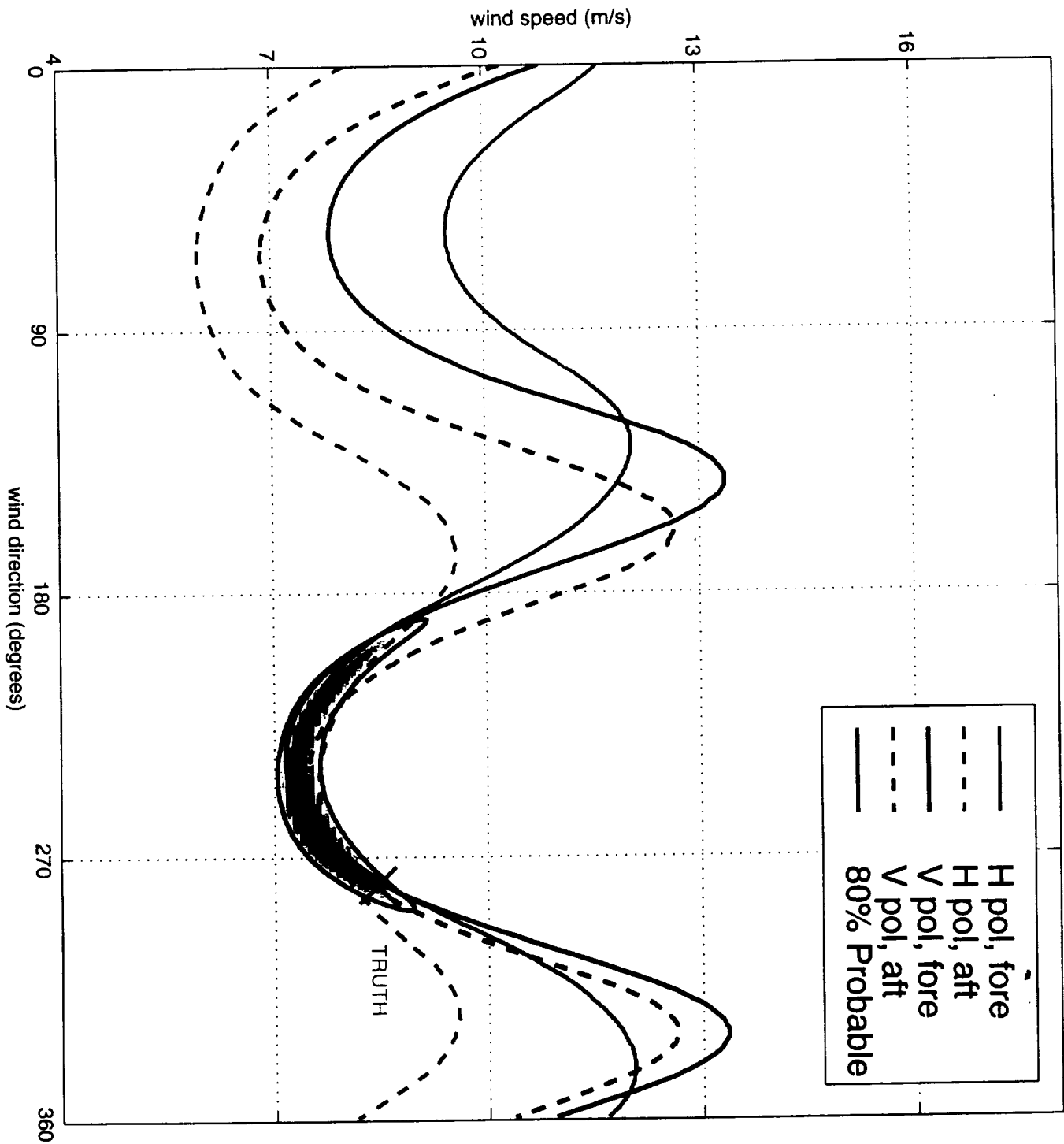
25 orbits



Sweet Spot Solution Curves and Probabilities



Mid-Swath Solution Curves and Probabilities

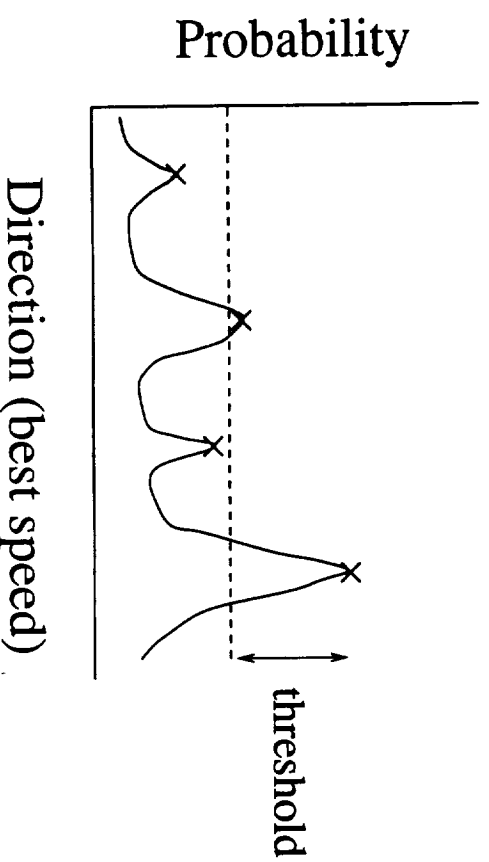


Mid-Swath Enhancement Technique

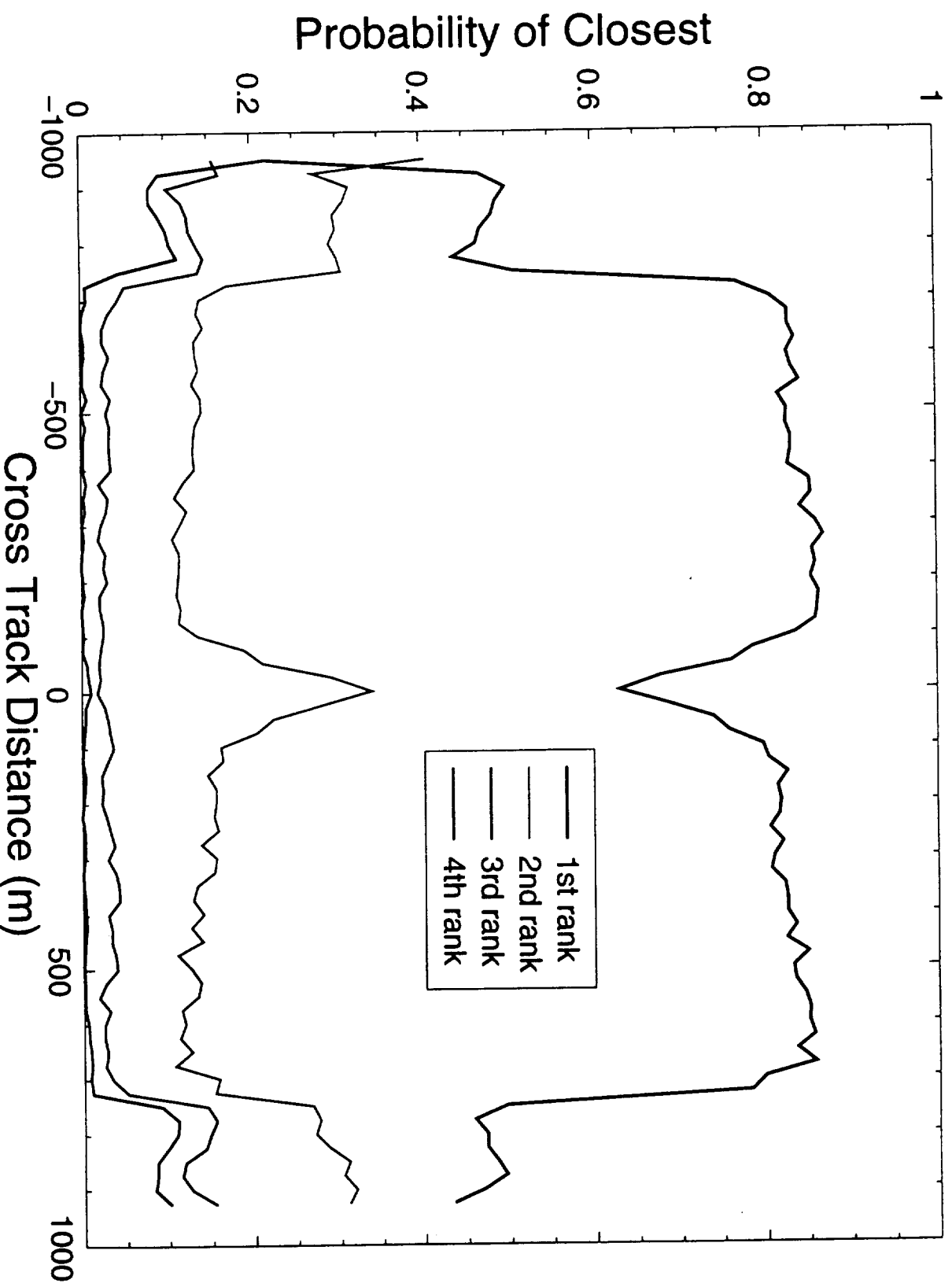
- pointwise wind retrieval
 - estimate 80 percent error bounds on retrieved ambiguities
- ambiguity removal
 - first stage: select best ambiguity
 - second stage: select best direction within the error bounds for that ambiguity

Far-Swath Enhancement Technique

- baseline wind retrieval:
 - locate up to four ambiguities
 - initialize the median filter with the closest of the top two ambiguities to the model field
 - median filter
- thresholded wind retrieval:
 - limit the number of ambiguities available for initialization based on a threshold value

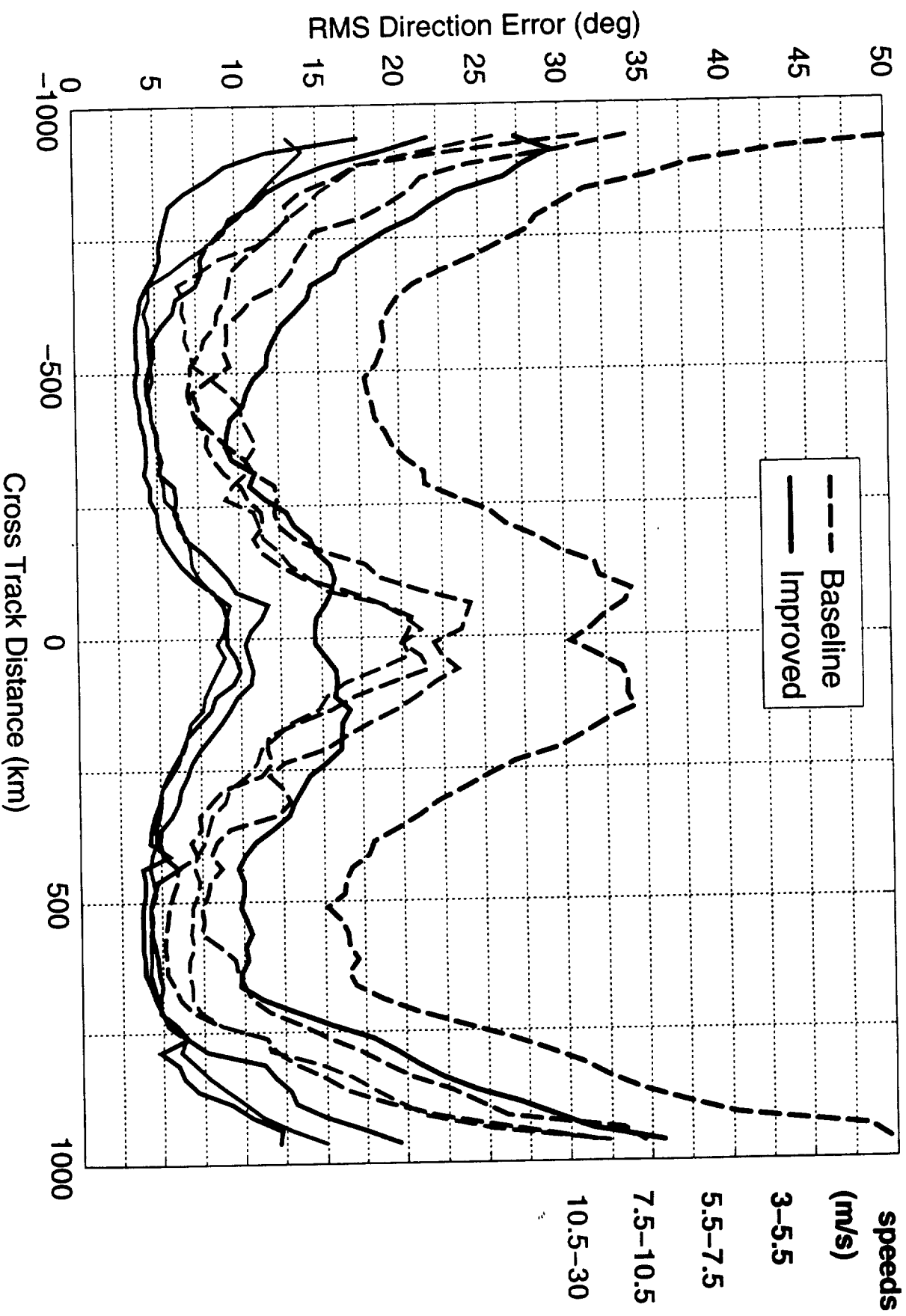


Closest Ambiguity by Rank



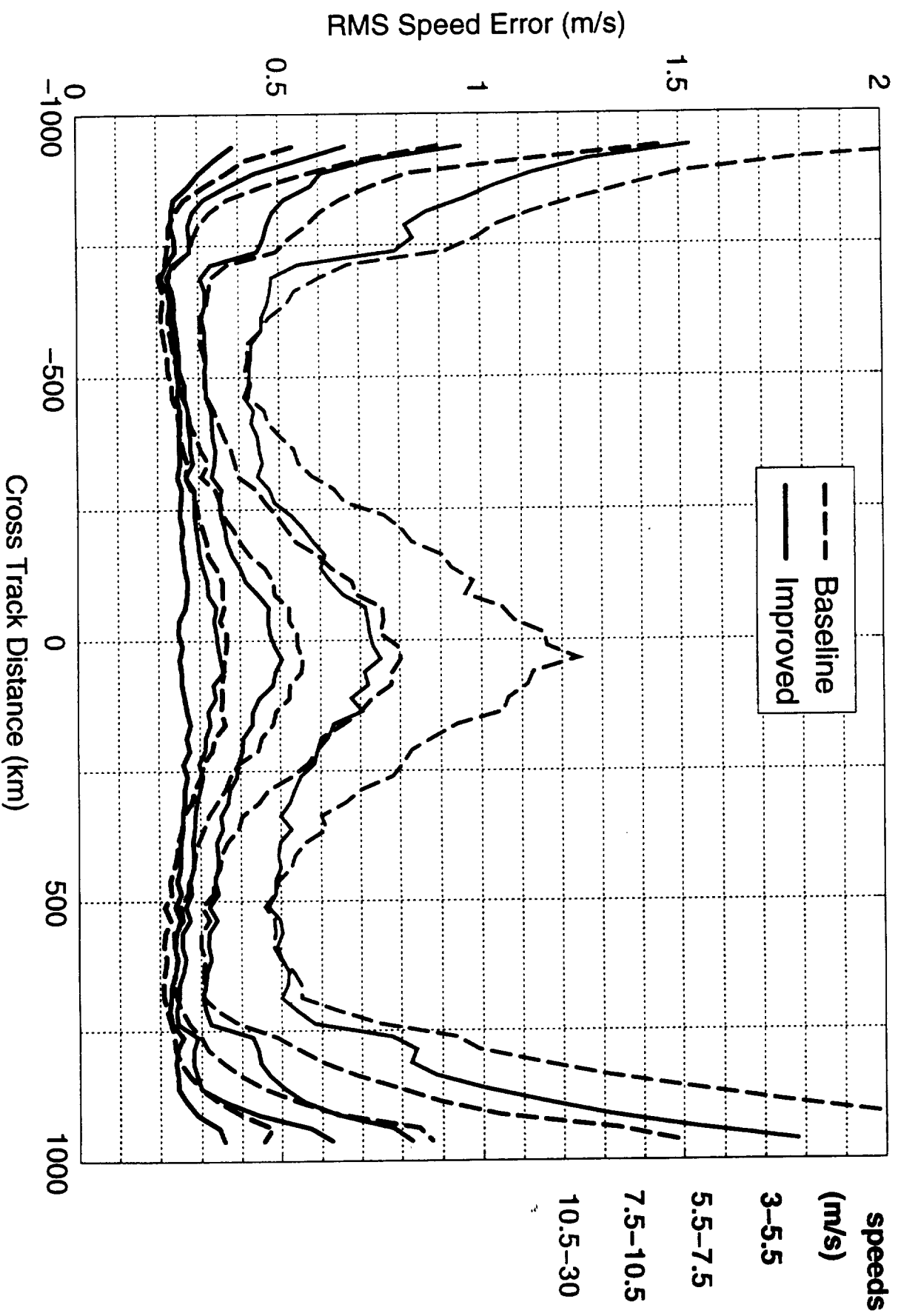
Comparison of Selected RMS Direction Error

25 orbits



Comparison of Selected RMS Speed Error

25 orbits



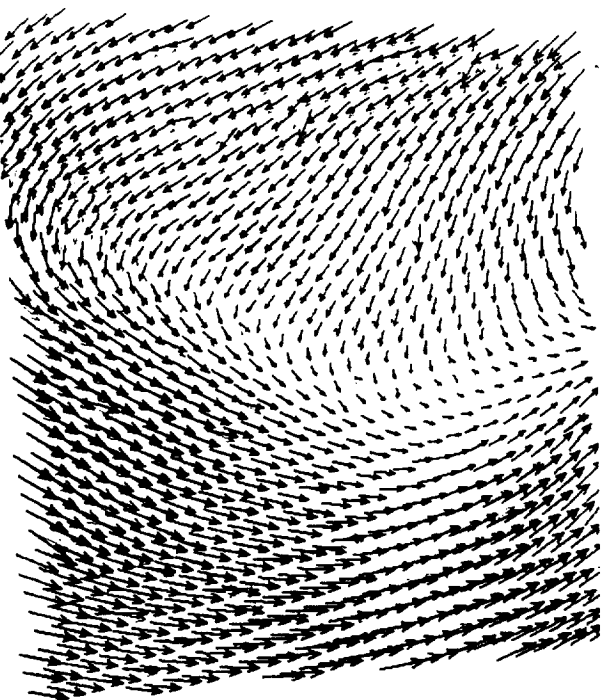
Example Wind Fields



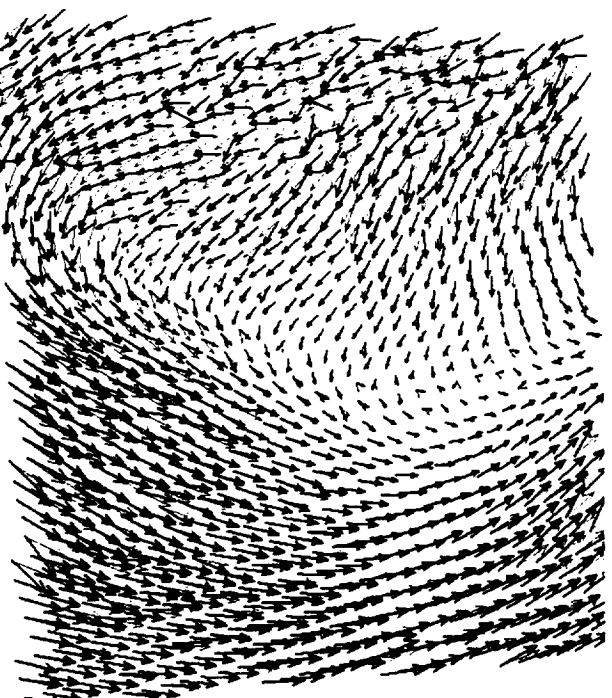
Wind field 1, Improved



Wind field 1, Baseline



Wind field 2, Improved



Wind field 2, Baseline